much disliked in many of these East African Bantu dialects, and either dropped or changed into a *y* sound. Certainly, according to the traditions of the Akikuyu, their upland country was until a hundred years ago (more or less) a region of unbroken forest (we may add, West African in its flora and fauna) which was nourished by an exceedingly heavy rainfall. This great equatorial forest of Africa obviously extended at one period right across the continent to the shores of the Indian Ocean. It has left traces of its peculiar flora and even fauna in the islands of Zanzibar and Pemba, and on the north coast of Lake Nyasa. This must have been a forest which contained not only the West African antelopes and pigs, birds, spiders, and butterflies, still found in Kikuyuland, but the gorilla and chimpanzee, and other types which once ranged uninterruptedly between West Africa and Further India. Consequently, Kikuyuland, from the point of view of palæontology, would, if there were any Tertiary or alluvial deposits (dried-up lakes, &c.), probably yield as interesting results in its exploration from that point of view as in ethnology and botany.

FIG. 2.—A Medicine Man. From "With a Prehistoric People."

The book under review, besides giving these interesting details as to the traditions and chronology of the Akikuyu, describes the people and their pursuits, their food and cookery, agriculture, domestic animals, arts and crafts, warfare and weapons, blood-drinking, betrothal and marriage, and general position of women, dances, initiation ceremonies, religion, conceptions of God, notions as to life after death, medicine, folk-lore; and also the position of this interesting people under the new British Administration. The authors have received much assistance from Mr. C. W. Hobley, one of the principal officials of East Africa, who is so very well known for his own ethnographical and linguistic studies of East African peoples.

Specially noteworthy are the illustrations and description of the Kikuyu "bull-roarer" used in various ceremonies, the modelling of fetishes (human figures), blacksmith's work, and initiation ceremonies, with their appropriate dances and costumes. In the interesting article on the medicine-man, the etymology of his name—Mundu Mugū—is not quite rightly hit off (in the quotation from Mr. McGregor). Mugū is really a contraction of the prefix and root of the widespread Bantu word Mu-logu, or Mu-logo, meaning magician, either good or bad. This root *-logo* ranges mainly over western Bantu Africa, and assumes sometimes very altered forms, such as -doki, -lozi, -roho. It is a parallel to the equally widespread root *nganga;* but *-logo* has to do rather with the evil side of magic or of spiritual influence, while *nganga* may well have been in its origin applied to some new wisdom from the north, something to do with iron-working or superior knowledge of a practical, material kind. (For instance, *Bu-nganga* in some Bantu languages means "gunpowder.")

There is an appendix to the book which gives an interesting note by the late Colonel J. A. Grant on iron-smelting in East Africa.

In their bibliography dealing with the Kikuyu and their language, the authors omit any reference to the present writer's vocabulary of Kikuyu in his work on the Uganda Protectorate. For various reasons, this vocabulary, though short, is of interest, as it represents the dialect of the westernmost part of the Kikuyu range, and is therefore interesting for comparison with the nearest (but very dissimilar) Bantu dialects of the regions immediately to the east of the Victoria Nyanza.

H. H. JOHNSTON.

## TEMPERATURES IN THE FREE ATMOSPHERE.[1]

DR. WAGNER has given us a comprehensive discussion of the temperature results obtained with registering balloons in Europe during the period July, 1902–June, 1907, and has incidentally furnished an excellent practical tribute to the collective publication

[1] "Die Temperatur Verhältnisse in der freien Atmosphäre [Ergebnisse der internationalen unbemannter Ballonaufstiege]." By Dr. Arthur Wagner. Beiträge zur Physik der freien Atmosphäre. Bd. iii. Heft 2–3. (Leipzig: Verlag von Otto Nemnich.)

of the international observations under the direction of Prof. Hergesell. The author's primary object was to deal with the annual variation of temperature, but he has found room also for the consideration of many associated questions. Altogether 380 ascents were considered, all of which reached 8 km. and twenty-nine of which reached 16 km. Doubtful observations were rejected.

The principal features in the annual variation of temperature are as follows. From the surface up to 3 km. the date of minimum temperature gets later and the annual range decreases by about 4° C. From 3 to 10 km. the minimum temperature occurs at the beginning of March, but at still greater heights there is a comparatively sudden jump back to the beginning of January. The annual range increases from 3 to 7–8 km. by about 4° C., then decreases up to 10 km. by about 6° C., and finally remains nearly constant from 11 to 16 km. The results agree, on the whole, with those obtained by the present writer and Harwood from a slightly different period of observation. Dr. Wagner deduces, from a consideration of the first two terms of the Fourier series expressing the variation, that the difference between the maximum and the mean temperature exceeds that between the mean and the minimum, and that this asymmetry increases with height; it appears doubtful if it is justifiable to neglect the third term, which increases with height and tends to diminish the asymmetry mentioned.

The effect of water vapour on the gradient of temperature is shown in the differences between winter and summer. The following table gives the gradients for summer (June, July, August) and winter (December, January, February), (1) from the present paper; (2) from the report of the present writer and Harwood; (3) for ascending saturated air:—

| Height km. | (1) Winter | (1) Summer | (2) Winter | (2) Summer | (3) Winter | (3) Summer |
|---|---|---|---|---|---|---|
| 1–2 | 3·3 | 5·3 | 2·2 | 5·6 | 5·6 | 5·1 |
| 2–3 | 4·5 | 5·0 | 4·3 | 5·6 | 6·5 | 5·4 |
| 3–4 | 5·7 | 5·6 | 5·6 | 5·4 | 6·8 | 5·5 |
| 4–5 | 6·2 | 6·1 | 6·5 | 6·0 | 7·3 | 6·0 |
| 5–6 | 7·0 | 6·6 | 7·0 | 6·3 | 7·9 | 6·5 |
| 6–7 | 6·9 | 6·9 | 7·3 | 7·1 | 8·6 | 7·1 |
| 7–8 | 7·0 | 7·4 | 7·6 | 7·3 | 9·0 | 8·0 |
| 8–9 | 5·9 | 7·2 | 6·6 | 7·3 | 9·3 | 8·5 |
| 9–10 | 5·0 | 6·1 | 5·1 | 7·1 | 9·6 | 9·0 |
| 10–11 | 3·5 | 3·9 | 3·6 | 4·3 | — | — |

From 3 to 8 km. the gradient is less in summer than in winter, while the difference between the "saturated" adiabatic gradients is greatest from 2 to 8 km. The approximation to the adiabatic state is closer in summer than in winter.

Dr. Wagner attributes the annual variation to convection and conduction from the earth's surface, to condensation of water vapour, and to radiation, solar and terrestrial. A further cause ought to be included, viz. the transference of energy in a horizontal direction. The effect of conduction might fairly be neglected, since even at 100 m., if conduction alone were active, the amplitude of the yearly variation would be less than 1/1000th of the amplitude at the surface. The decrease of the amplitude up to 3 km. appears to be a result of the action typified by v. Bezold's law. The increase above 3 km. is probably rightly attributed to the effect of the increased water vapour on the average gradient in the summer months. Condensation of water vapour is, moreover, held responsible for the relatively slow cooling of the middle layers from summer to autumn, but it is probable that the above-mentioned horizontal transference of energy and the radiation also contribute to this effect. The radiation tends to increase the temperature of the earth and lower atmosphere when the amount of water vapour is increased, if the effect is not counterbalanced by increased reflection of solar radiation from clouds. In this connection it may be pointed out that there is no experimental evidence to justify the assumption repeatedly made that the air between 3–4 and 8 km. may be regarded as diathermanous. At 5 km. the average vapour pressure is not much below 1 mm., and the experiments of Paschen and Rubens and Aschkinass show that for a vapour pressure of 1 mm. half the radiation of a full radiator between 12 and 20$\mu$ would be absorbed by a path of about 400 m., and half that between 5 and 8$\mu$ by a path of 50 m., while the $CO_2$ absorption would add slightly to the absorption in the former region; and these results are affected but little by the later experiments of Scheiner and von Bahr.

Dr. Wagner finds that the departures of the temperature in different localities from the general mean values are small except for south Europe, where the temperature is considerably above the mean in the convective region, and for east Europe, where the converse is the case. The peculiarity in the latter region is largely due to the influence of Pavlovsk, lat. 60°, which is the only station in the region besides Koutchino, lat. 56°.

The mean value of $H_c$, the height at which the advective region is reached, for different regions is as follows:—

| Central | North | South | East | West Europe |
|---|---|---|---|---|
| 10·54 | 10·18 | 11·07 | 10·22 | 10·62 km. |

Dr. Wagner deduces from these results that the value of $H_c$ decreases from ocean to continent, as well as from equator to pole. It is true that radiation effects alone would tend to make $H_c$ less over a dry continental area than over the ocean at the same or a higher temperature, but it is doubtful if such an effect can be traced in these figures, according to which north Europe (Berlin and Hamburg) has a lower value than east Europe (Pavlovsk and Koutchino).

In considering the variation of temperature with the pressure distribution, Dr. Wagner wisely adopts the plan of eliminating the annual variation, and as he uses no ascents from east or south Europe, the correction for the local variation of temperature is inconsiderable. It ought, however, to be remembered that, although the mean temperatures of the year are not far different, say, for Paris and Vienna, the corrections to be applied to ascents made in the same month at those two places are not necessarily the same. Dr. Wagner's results corroborate those previously found in proving that cyclones are in general colder than anticyclones, but a consideration of special cases led to the important conclusion that for rapidly moving systems these conditions were reversed, a result foreshadowed by the work of Hanzlik.

The mean temperature in October at 2 km. over Berlin on p. 95 is wrongly given as 0·6° C., and this error is mainly responsible for the peculiar change in the half-yearly variation at that height. In differentiating $\Delta b$ on p. 99 the variation of T is not negligible. It is simpler to proceed from the fundamental equations, which lead to the result that the height at which $\Delta b$ is a maximum is given by

$$h = RT_M{}^2/T_h = RT_0 \text{ nearly,}$$

where

$$\frac{h}{T_M{}^2} = \int_0^h \frac{dh}{T^2}$$

and $T_h$ is the temperature at the height $h$ and $T_0$ that at the surface.

The paper includes useful tables giving the pressure and the density at different heights, the variation of temperature on surfaces of equal pressure, and the temperatures in different quadrants of cyclones and anticyclones.

It is full of interest, and stands as an example of the "thorough" policy of Prof. Hann, to whom, indeed, it would not do discredit. E. GOLD.

## *THE GULF STREAM DRIFT AND THE WEATHER OF THE BRITISH ISLES.*

ALTHOUGH it has been known for very many years that the climate of these islands and of northern Europe generally is far milder than it would otherwise have been owing to a large body of warm water flowing past its shores from the south-west, it is only within recent years that attempts have been made to trace any detailed connection between the state of the Gulf Stream Drift[1] and the weather.

Now that systematic hydrographic observations have been accumulating for a number of years it is becoming possible to attack seriously this interesting problem, and the results so far obtained certainly look promising.

The immediate causes of the weather in the British Isles are undoubtedly to be sought in the various atmospheric disturbances which arrive from the Atlantic, but there can be no doubt that another very important factor to be considered is the temperature of the adjacent seas. This is influenced by the Gulf Stream Drift.

The problem is, however, complicated by the fact that there is some doubt as to whether the Gulf Stream Drift may not be a direct result of the atmospheric circulation in the huge cyclonic system which rests over the North Atlantic, with its centre at Iceland.

Be that as it may, there is undoubtedly a very intimate connection between the oceanic and atmospheric circulations in the North Atlantic region, so that if the atmospheric circulation becomes more vigorous, the Gulf Stream Drift moves faster, and *vice versâ*. This is well shown in a paper by Meinardus in the *Meteorologische Zeitschrift,* xxii., 398, 1905. Such a connection was, however, to be expected, not only if the Gulf Stream Drift were directly due to the atmospheric circulation, but also if, as seems more probable, both were due to the same cause, namely, the excessive cooling at the poles of the earth, coupled with the rotation of the earth about its axis. On this view both the oceanic and atmospheric circulations are of the nature of convection currents, and primarily due to the same cause, but in the course of ages these two distinct circulations have so adjusted themselves that any change in the one rapidly causes a corresponding change in the other.

It seems probable, therefore, that the Gulf Stream Drift, owing to its inertia and its great heat capacity, should have a similar effect to that of the flywheel of an engine, and tend to obliterate the disturbances due to the more unstable and variable atmospheric circulation. In this case the Gulf Stream Drift should have a very considerable regulating influence on the *general* type of weather prevailing in the British Isles.

Let us consider the probable influence on the temperature and on the rainfall. In the winter the temperature of the Gulf Stream Drift is higher than that of the land, while in the summer it is lower. Consequently during the winter time the winds blowing from the Atlantic tend to raise the temperature of the land, while in the summer they tend to lower it, and it is clear that variations in the temperature of the Drift must be expected to affect the temperature of the winds blowing over it, and consequently the temperature on land as well. Such effects on the land temperature will probably be far more important in the winter than in the summer, owing to the relatively greater power of the solar radiation during the summer.

The effect on the rainfall will be equally marked, for the amount of moisture carried by the winds and available for precipitation as rain depends largely upon the temperature of the sea over which they have blown. The warmer the sea the more moisture is taken up and the more precipitation may be expected on the neighbouring land.

In this way, for instance, it is possible to account for the low rainfall last year in the western parts of Great Britain and Ireland—parts which are usually very wet—for during 1909 the temperature of the Gulf Stream Drift was below the normal, and hence the winds blowing from it were not so heavily charged with moisture as usual.

The somewhat lower land temperature seems to have just about compensated for this by the time the winds reached the east of Great Britain, so that the rain fell there instead of in the west. The result of this was an abnormally high rainfall in the east, and with the low one in the west the rainfall over the British Isles as a whole was exactly equal to the average.

It will be very interesting to see if this is what may be generally expected in years when the Gulf Stream Drift is weaker than usual.

There is clearly a possibility of being able to predict the *general* character of the weather in these islands several months in advance from the results of hydrographic observations. It is, of course, a very complex question, and at present one cannot be too confident, but I am certainly of the opinion that such predictions will be possible.

In another place I have thrown out the suggestion that, as the February hydrographic observations made in the Irish Sea this year were almost identical with those of last year, there was some probability that the weather during 1910 would be somewhat similar to that of last year. It was never expected that the suggestion would attract the attention it has done, but it is interesting to note that the May hydrographic observations are also very similar to those of last year—if anything, even less favourable.

H. BASSETT.

[1] The warm water flowing round the British Isles to Scandinavia used to be called the Gulf Stream. The Gulf Stream proper is now considered not to extend further east than Newfoundland, while its fan-like extension which crosses over to Europe is known as the Gulf Stream Drift.

## *PROF. G. V. SCHIAPARELLI.*

PROF. SCHIAPARELLI, whose death we briefly announced last week, for many years occupied a prominent position in the world of science. Half a century has passed since he began his career as second assistant in the Brera Observatory of Milan, and nearly as many since he was elected to fill the position of director. In that position he exhibited much energy, and increased the reputation of the observatory. But his greatest success came to him early, and though he worked long and diligently, giving evidence of patient industry and practical skill as an observer, he will be remembered mainly for having satisfactorily established the connection between meteors and comets. It was a brilliant discovery founded on acute penetration and sound reasoning. It was, moreover, a discovery that the public were able to appreciate, and by popular applause he was lifted at once into the front rank